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Further species within Arecaceae (Palmae; Coryphoideae) to non-native flora of Tunisia and North Africa

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Key words: Alien flora, *Phoenix, Washingtonia, Livistona,* Monocots.

Ključne besede: tujerodna flora, *Phoenix*, *Washingtonia*, *Livistona*, enokaličnice.

Abstract

Five new alien taxa are here recorded from Tunisia. Reported taxa (*Livistona chinensis*, *Phoenix canariensis*, *P. reclinata, P. theophrasti* and *Washingtonia robusta*) belong to the subfamily Coryphoideae (Arecaceae). Updated nomenclature, brief descriptions, general and national distributions are provided for each species. *Livistona chinensis* and *Phoenix theophrasti* are here reported for the first time in North Africa. Identification keys are also provided.

Izvleček

V članku predstavljamo pet novih tujerodnih taksonov iz Tunizije. Vsi zabeleženi taksoni (*Livistona chinensis*, *Phoenix canariensis*, *P. reclinata, P. theophrasti* and *Washingtonia robusta*) pripadajo poddružini Coryphoideae (Arecaceae). Za vsako vrsto smo prikazali posodobljeno nomenklaturo, kratek opis, splošno in nacionalno razširjenost. *Livistona chinensis* in *Phoenix theophrasti* sta prvič zabeleženi v severni Afriki. Predstavili smo tudi določevalne ključe.

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Introduction

The palms, family Arecaceae (Palmae) are one of the most morphologically diverse families in Monocots. Since early molecular and phylogenetic investigations (see e.g., Chase et al. 2000, Stevenson et al. 2000, APG IV 2016), Arecales are most closely aligned with Poales, Commelinales and zingiberales within the Commelinids clade. Morphologically, palms are differentiated from other monocot families by two main characters: a "woody" stipe/stem and leaves that are plicate in bud and segmented (Uhl & Dransfield 1987). Formal classification of the Araceae recognised six subfamilies that include about 190 genera and ca. 2600 species (Uhl & Dransfield 1987, 1988, 1999). The Coryphoideae with 45 genera is the second more rich subfamily after Arecoideae (Asmussen et al. 2006) and is characterised by palmate and pinnate leaves with flowers solitary or in sympodial clusters (Uhl & Dransfield 1987). Genera belong to six tribes, among which *Livistona* R.Br. (Corypheae tribe), *Washingtonia* H.Wendl. (Trachycarpeae tribe) and *Phoenix* L. (Phoeniceae tribe). Species belonging to such genera are perennial climbers, shrubs and trees and distributed across the tropics and warm temperate regions of the world (Stevens 2012).

In Tunisia, palm family consists of two genera (*Chamaerops* and *Phoenix*) with three species of which *P. canariensis* is considered cultivated (Dobignard & Chatelain 2010).

In continuity to ongoing botanical researches aiming at improving the knowledge on the Tunisian vascular flora (see e.g., El Mokni et al. 2015a, 2015b, 2015c, 2019a, 2019b, El Mokni & Peruzzi 2019, Iamonico & El Mokni 2018, Domina & El Mokni 2019, El Mokni 2020, El Mokni et al. 2020) and mainly on Monocots s.lat. (see e.g., El Mokni & El Aouni 2011, 2012, El Mokni et al. 2010, 2013, 2014, El Mokni 2018a, 2018b, 2018c, El Mokni & Domina 2018, 2019; El Mokni & Tison 2018, El Mokni & Verloove 2017, 2019a, 2019b), five new taxa within Arecaceae (subfamily Coryphoideae) were recorded during field work carried out during the period 2010–2020 from Jendouba (NW-Tunisia), Bizerta and Mannouba (NE-Tunisia), Mahdia, Monastir and Sousse (CE-Tunisia). These recorded five taxa are *Livistona chinensis* (Jacq.) R.Br. ex Mart., *Phoenix canariensis* H.Wildpret, *P. reclinata* Jacq., *P. theophrasti* Greuter and *Washingtonia robusta* H.Wendl.

Materials & Methods

Extensive field prospections within central and northern Tunisia (North Africa), mostly between 2010 and 2020, has revealed new national and even North-African records. Records here reported are documented by brief description of each species. The actual status of naturalization for each taxon is assessed based on literature analysis (Pyšek et al. 2004). Taxa identification follows Dowe (2009), Starr et al. (2003), Tutin et al. (1980), Flora of North America (2020) (retrieved from http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=125080), Flora of China (retrieved from http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=118760), CABI (2020), some additional comments based on the authors' observations of living individuals. Further comments on flowering/fruiting periods, distribution, habitats occupied and field photographs are presented for each newly reported taxon. Identification keys are also given.

Photographed specimens here presented from El Mokni's collection (not online, yet) are used as specimens visa.

The paper is divided in three parts in which taxa (tribus, subtribus -when exist-, genera and species) are arranged in alphabetical sequence. Nomenclature of the taxa presented is mostly in accordance with recent phylogenetic classification of the palm family (see e.g., Dransfield et al. 2005, 2008, Bacon et al. 2012, Baker & Dransfield 2016) and some databases such as Tropicos (Tropicos 2020), the International Plant Names Index (IPNI 2020) and The Plant List (The Plant List 2020).

Results & taxonomic notes

Within Arecaceae, subfamily Coryphoideae, five species (belonging to three genera) and two genera are here added to non-native flora of Tunisia. Among them, one genus (*Livistona* R.Br.) is here firstly cited for Mediterranean basin and for North Africa, also two species (*Livistona chinensis* (Jacq.) R. Br. ex Mart., *Phoenix theophrasti* Greuter) are here reported for the first time in North Africa. An updated key to all the genera of the family is here proposed.

Analytical key of genera within Tunisian Arecaceae

1. Leaves pinnate, elongate ..... *Phoenix*.
1'. Leaves ± palmate, triangular to rounded ..... 2.
2. Shrub, leaves triangular fan-shaped, dioecious ..... *Chamaerops*.
2'. Tree, palmate leav ..... 3.
3. Petiole split at base; leaf segments filiferous; monoecious ..... ***Washingtonia***.
3'. Petiole not split at base; leaf segments not filiferous; hermaphroditic ..... ***Livistona***.

Below are cited new reported taxa with their appropriate tribus and subtribus, when exist.

I. Tribe Corypheae Martius in Endlicher, Gen. Pl.252. 1837.

Subtribe Livistoninae Saakov, Palms and Their Culture in the U.S.S.R. 793.1954.
Genus Livistona R. Br., Prodr. Fl. Nov. Holland. 267–268. 1810.

Plants small to large. **Stem/stipe** solitary, erect, slender, at first covered by persistent leaf sheaths, later becoming bare or covered with persistent petiole bases, ringed conspicuously or obscurely with leaf scars. **Leaves** palmate or costapalmate, petiole not split at base, strongly armed. **Inflorescences** axillary within crown of leaves, paniculate with 3–5 orders of branching, about as ± as long as leaves. **Flowers** bisexual, borne singly along rachillae. **Fruits** drupe, blackish, smooth. **Seeds** globose or ellipsoid.

The genus *Livistona* R.Br. includes ca. 36 species that have a wide distribution from the Horn of Africa and Southern Arabia to throughout southeastern and eastern Asia, Malesia and Australia (Dransfield et al. 2008, Dowe 2009).

Livistona chinensis (Jacq.) R.Br. ex Mart., Prodr. Fl. Nov. Holland. 268. 1810 ≡ *Latania chinensis* Jacq., Fragm. Bot. 16. t. 11. f. 1. 1801 ≡ *Saribus chinensis* (Jacq.) Blume, Rumphia 2: 48.1838 ≡ *Livistona mauritiana* Wall. ex Voigt, Hort. Suburb. Calc. 641. 1845 ≡ *Livistona subglobosa* (Hassk.) Mart., Hist. Nat. Palm. 3: 319. 1853.

Hermaphroditic palm with short and stout **trunk** up to 15 m tall, 20–30 cm in diameter, rough with leaf scars. **Leaves** palmate, petioles to 1.8 m long, with green or black recurved spines along margins, spines denser proximally, fewer distally on petioles; blades almost circular in outline, 1.2–1.8 m wide, green on both surfaces, regularly divided to c. half their length, these split and pendulous at apices. **Inflorescences** 1–1.2 m long, branched to three orders, light yellow when young and then become green with unpleasant odor, with six or seven partial inflorescences; flowers hermaphroditic, small, sessile in groups of 2–4 flowers, white or yellow, 2–2.5 mm. **Fruits** green or blue-green, globose to ellipsoid or pyriform,15–26 mm long, 9–18 mm wide, glossy blue-green to bright green; epicarp ceramic-like (Dowe 2009, Flora of China Editorial Committee 2016).

Flowering period: October to December, **Fruiting period**: January to February (-March).

Notes on general distribution: *L. chinensis* is native to Eastern Asia including China, Japan (i.e., Ryukyu Islands, Bonin Islands) and Taiwan (Horikawa 1972, Suzuki 1982, Yoshida et al. 2000, USDA-ARS 2016). The species is widely cultivated as an ornamental and can be found naturalized in the West Indies, tropical America and on many islands in the Indian and Pacific Oceans (Wagner et al. 1999, Meyer et al. 2008, Flora of China Editorial Committee 2016, Govaerts 2016, PIER 2016). *L. chinensis* is considered invasive in Bermuda (Kairo et al. 2003) and in Mauritius and La Réunion Islands (Moore & Guého 1984, Strahm 1993, 1999). Within the Mediterranean basin, this taxon seems to be reported only in Portugal and Spain (GBIF database 2020). It is also reported to be growing in riparian forest areas in New Caledonia (Hequet et al. 2009). No records were made up till now for North Africa (see e.g., Govaerts 2020, APD 2020).

Occurrence in Tunisia (Figure 1) **and casual status**: Tunisian plants grow within sidewalks near a private garden, in the government of Monastir. Since the taxon was found only at one locality, with one mature individual and more than 30 juvenile seeds germinations were observed, and this appears to be an occasional resulting from the use of imported seed mixtures for gardening purposes. According to Pyšek et al. (2004), and Richardson & Pyšek (2006) *Livistona chinensis* is evaluated as casual in Tunisia.

Specimina Visa: TUNISIA: Monastir (Monastir-City), sidewalks near a private garden, 35° 46' 02" N, 010° 49' 53" E, 15 m a.s.l., 14 February 2019, *El Mokni* (*photos*).

II. Tribe Trachycarpeae Satake, Hikobia 3:121. 1962.

Genus Washingtonia H.Wendl., Bot. Zeitung (Berlin) 37(5): 68. 1879.

Plants tree palms. **Stems** solitary, erect, tall, partly or completely covered with old leaf bases and marcescent dry leaves forming conspicuous skirt around trunk. **Leaves**: sheath fibers soft; petiole split at base, conspicuously armed with teeth along margins; blade costapalmate; plication induplicate; segments lanceolate, basally connate, bearing fibers between segments. **Inflorescences** axillary within crown of leaves, paniculate, arching well beyond leaves, with 2 orders of branching. **Flowers** bisexual, short- pedicellate. **Fruits** drupes, blackish.

The genus *Washingtonia* H.Wendl. is made up of two species native to the southwestern United States (in southern California, southwest Arizona, (Nevada) Texas) and northwest Mexico (in northern Baja California and Sonora) (Jones 1995). *Washingtonia filifera* (Linden ex André) H.Wendl. ex De Bary and *W. robusta* H. Wendl. (Oppenheimer & Bartlett 2002). There are also hybrids between the two, which are sometimes referred to as *W. ×filibusta* Hort. ex Hodel. (Hodel 2014). Both species were commonly cultivated across the southern United States, the Middle East, southern Europe, and North Africa.


B
A
C

Washingtonia robusta H.Wendl. Berliner Allg. Gartenzeitung 2: 198. 1883 ≡ *Neowashingtonia robusta* (H.Wendl.) A.Heller. Cat. N. Amer. Pl.: 3. 1898 ≡ *Pritchardia robusta* (H.Wendl.) Schröt.Schweiz. Gartenbau 7: 8. 1931.

Monoecious, self-compatible, fast growing palm with a slender **trunk** that gradually tapers from ground level to the crown (15 to 20 m high and 0.6 to 1.2 m in diameter). **Leaves** with 40 to 60 segments, divided nearly to middle of frond and attached to the tree with a 1.2–1.5 m long plano-convex petiole. Red brown petioles exhibit curved spines on their entire length. Tubular, creamy pink **flowers** are borne in panicles up to 3 m, bearing numerous small, white bisexual flowers in compound clusters. **Fruits** small black, ovoid-oblong to spherical drupes (Brickell & Zuk 1997, Turner & Wasson 1997, Broschat 2017, Bailey 1936, Felger & Joyal 1999, Brown & Brown 2012).

Flowering period: June to August, **Fruiting period**: September to November (-December).

Notes on general distribution: *Washingtonia robusta* is native to the arid regions in northwest mainland Mexico (McCurrach 1960, Jones 1995) and the Baja California where it may have originated (Cornett 1989) and where it is still widespread (Fonseca 1999, Minnich et al. 2011). It is also on record for the Sonora Desert in both Mexico and Southern California (Felger & Joyal 1999, Minnich et al. 2011). Distributed globally as a horticultural plant (Spennemann 2018), *Washingtonia robusta* is regarded as naturalized beyond its natural range in Southern California (Cornett et al. 1986), Southern Florida (Institute for Regional Conservation 2016), Reunion Island (Indian Ocean) (Meyer et al. 2008), the North Island of New Zealand (Martin 2009), and parts of Hawaii (Oppenheimer & Barlett, 2002, Starr et al. 2003). Within Europe and the Mediterranean basin, the plant is reported in Portugal, Spain, France, Italy, Sardegna (see e.g., Verloove 2013, APD 2020, GBIF database 2020). In North Africa, the taxon is reported only in Canary Islands and Algeria (see e.g., Acebes Ginovés et al. 2004, Zeddam & Raus 2016, APD 2020).

Occurrence in Tunisia (Figure 2) **and status of naturalization**: Tunisian plants from seedlings germination of *Washingtonia robusta* found in many localities occur usually in small number of scattered individuals along sidewalks and near agglomerations, where the plant was introduced. Moreover, small populations have also been observed, especially along the metro railways (Sousse towards Mahdia) and in the surrounding of "Lac Tunis" where the most large population is reported with more than 60 mature individuals (up to 5m high) within an area of about 1 ha. According to Pyšek et al. (2004) criteria and categorisation, *Washingtonia robusta* can be considered as a naturalized alien species in Tunisia.

Taxonomic notes: *Washingtonia robusta* can be distinguished from *W. filifera* by its thinner and taller trunk. Lower leaves persist on the tree after they die, forming a dense, brown, shaggy covering below the living, bright green, broad, fanshaped leave with hairy filament. In addition, Stalk of the leaves is spiny and shorter than *W. filifera* (Brickell & Zuk 1997, Oppenheimer & Bartlett 2002).

Specimina Visa: TUNISIA: Monastir, Monastir-City, roadsides and sidewalks and as epiphytic on *Phoenix canariensis* H. Wildpret, 35° 46' 02" N, 010° 49' 55" E, 15 m a.s.l., 23 January 2017, *El Mokni* (*photos*); Bizerta, Bizerta-City, in abandoned fields, 37°16' 07" N, 009° 51' 28" E, 10 m a.s.l., 26 July 2017, *El Mokni* (*photos*); Mahdia, near railways station, 35° 29' 48" N, 011° 03' 38" E, 2 m a.s.l., 25 January 2020, *El Mokni* (*photos*); Manouba, surrounding "Lac Tunis", near Moncef Bey station, 36° 47' 31" N, 010° 11' 35" E, 1 m a.s.l., 05 October 2016, *El Mokni* (*photos*).

III. Tribe Phoeniceae Drude in Martius, Fl. Brasil. 3(2): 279. 1881.

Genus Phoenix L., Sp. Pl.2:1188. 1753; Gen. Pl. ed. 5. 496. 1754

Stems solitary or clustered, erect or ascending often clothed in old leaf bases. **Leaves** sheath fibers soft; petiole not split at base, armed; blade pinnate; plication induplicate; segments lanceolate, in 1 or more planes; basal segments modified into stout spines. **Inflorescences** in pedunculate spadices, with few, simple branches, axillary within crown of leaves, paniculate, ascending, much shorter than leaves, with 1 order of branching; spathe 1. Dioecious, **flowers** yellowish; staminate flowers borne singly along rachillae. Pistillate flowers borne singly on rachillae. **Fruits** drupes, berrylike, fleshy; exocarp blackish brown, smooth. **Seed** one, elongate, deeply grooved along ventral side (Tutin et al. 1980).

← **Figure 1:** *Livistona chinensis* in Tunisia. A: Stem/stipe solitary, erect, slender, covered by persistent leaf sheaths; B: Infrutescences axillary within crown of leaves, paniculate with 3–5 orders of branching, about as long as leaves in fruiting period; C: Fruits glossy blue-green; epicarp ceramic-like. Photos by Ridha El Mokni (14. 02. 2019).

Slika 1: *Livistona chinensis* v Tuniziji. A: posamezno steblo, pokončno, vitko, prekrito z ostanki listov; B: soplodje je znotraj krošnje listov aksilarno, 3–5 krat razvejano, približno tako dolgo, kot listi v času plodenja; C: sijoči modro-zeleni plodovi; epikarp je "keramičast". Fotografije Ridha El Mokni (14.02. 2019).


A
B
C
D

The genus *Phoenix* L. includes 14 species (Govaerts & Dransfield 2005) traditionally distributed in the Old World from the Canary and Cape Verde islands in the Atlantic Ocean, throughout Africa, Madagascar and Asia, reaching Sumatra, Taiwan and the Philippines in the East (Barrow 1998, Dransfield et al. 2008).

In Tunisia, the genus was represented only by one species (*P. dactylifera* L.), we here reported the occurrence of three more non-native species. An update analytical key for all species is here proposed.

Analytical key for Tunisian species belonging to the genus *Phoenix* L.

1. trunk multiple ..... ***P. reclinata***.
1'. trunk solitary ..... 2.
2. Fruits 25–75 mm;..... *P. dactylifera*.
2'. Fruits 14–23 mm;..... 3.
3. Fruits 15–23 mm; mesocarp succulent, orange to dark purple ..... ***P. canariensis***.
3'. Fruits 14–16 mm; mesocarp fibrous, yellowish-brown to blackish..... ***P. theophrasti***.

1.*Phoenix canariensis* H.Wildpret, Prov. Agric. Hort. Ill. 2: 293–295, fig. 67–68. Oct. 1882, nom. cons.

Dioecious large palm up to 18 m tall, with a thick erect **trunk** up to 1.2 m in diameter and a crown occupying the upper 2.5–4.5 m. **Leaves** up to 1.5–1.8 m long are alternate and pinnately compound, containing lanceolate leaflets 30–45 cm long with sharp spines 5–8 cm long on the lower half of the petiole. **Flowers** creamy yellow-white and open from a husk-like structure that appears periodically throughout the year. **Fruit** elliptical fleshy drupe, 1–3 cm long, occurring in hanging clusters, each containing a single large seed, mesocarp orange-brown to dark purple (Gilman & Watson 1994).

Flowering period: March to April, **Fruiting period**: May to July.

Notes on general distribution: *Phoenix canariensis* is native to Canary Islands (Santos Guerra 1994, Morici 1998). It was introduced to mainland Europe from the 1600s, and around the Mediterranean including North Africa and West Asia, and was introduced across the Atlantic Ocean from as early as the 1700s as an ornamental palm, first by Spanish missionaries and colonizers, such as to California, Central and South America. It has since then been widely introduced as a popular ornamental palm, to parts of Australasia, Asia and Africa (CABI 2020). It has recently been noted naturalizing and becoming invasive in southern California (DiTomaso & Healy 2006, Cal-IPC 2006) and northern New Zealand, mostly in riverine wetland and coastal habitats (Esler & Astridge 1987). Planted widely, seeds are eaten and spread by birds (DiTomaso & Healy 2006). Within the Mediterranean basin, the taxon is mainly reported in the Iberic peninsula, France and Italy (GBIF database 2020). In North Africa, the species was cited only for Morocco and Algeria with no records made up till now for Tunisia (see e.g., APD 2020, GBIF database 2020).

Occurrence in Tunisia (Figure 3) **and status of naturalization**: we found juvenile individuals of *Phoenix canariensis* in many Tunisian localities (within Ariana, Bizerta, Jendouba, Mahdia, Monastir, Sousse) along sidewalks and near agglomerations as epiphytic on *Melia azedarach* L., where the plant was introduced since more than 50 years ago. Hence this ornamental palm can produce a dense mat of seedlings, that can thrive in a variety of habitats and soil types, and can tolerate high temperatures and salt winds, more than 300 individuals in different ages were reported during the last two years between Sousse and Mahdia Cities, along the metro railways. According to Pyšek et al. (2004) criteria and categorisation, *Phoenix canariensis* can be considered as a naturalized alien species in Tunisia.

Specimina Visa: TUNISIA: Ariana, roadsides and sidewalks, 36° 49' 39" N, 010° 10' 57" E, 10 m a.s.l., 23 December 2014, *El Mokni* (*photos*); Bizerta, roadsides and sidewalks as epiphytic on *Melia azedarach* L., 37° 16' 15" N, 009° 52' 31" E, 5 m a.s.l., 20 January 2019, *El Mokni* (*photos*); Jendouba, roadsides and sidewalks, 36° 30' 03" N, 008° 47' 04" E, 145 m a.s.l., 11 October 2008, *El Mokni* (*photos*); Mahdia towards Sousse, along the metro railways, Sidi-Mesaoud 35° 31' 15" N, 011° 01' 37" E, 25 m a.s.l., 04 April 2019, *El Mokni* (*photos*); Moknine-Gribaâ 35° 38' 12" N, 010° 54' 29" E, 20 m a.s.l., 04 April 2019, Sahline 35° 45' 41" N, 010° 41' 46" E, 20 m a.s.l., 04 April 2019; Sousse, roadsides and sidewalks, 35° 46' 05" N, 010° 38' 34" E, 5 m a.s.l., 04 April 2019, *El Mokni* (*photos*); Monastir-City,

Figure 2: *Washingtonia robusta* in Tunisia. A: different juvenile plants from seedling within a public garden (Monastir, CE Tunisia; 29. 12. 2018); B: habit of a vigorous plant from seedling under old walls (Monastir-City, CE Tunisia; 23. 01. 2017); C: juvenile plant from seedling as epiphytic on *Melia azedarach* (Bizerta-City, NE Tunisia; 09. 02. 2020); D: juvenile plant from seedling as epiphytic on *Phoenix canariensis* (Sousse, CE Tunisia; 19. 05. 2018). Photos by Ridha El Mokni.

Slika 2: *Washingtonia robusta* v Tuniziji. A: različne mlade rastline v javnem vrtu (Monastir, CE Tunizija; 29. 12. 2018); B: izgled vitalne rastline pod starimi zidovi (Monastir-City, CE Tunizija; 23. 01. 2017); C: mlada rastlina iz sadike kot epifit na vrsti *Melia azedarach* (Bizerta-City, NE Tunizija; 09. 02. 2020); D: mlada rastlina iz sadike kot epifit na vrsti *Phoenix canariensis* (Sousse, CE Tunizija; 19. 05. 2018). Fotografije Ridha El Mokni.


A


B


C


d

roadsides and sidewalks, public gardens 35° 45' 56" N, 010° 49' 49" E, 15 m a.s.l., 04 December 2018, *El Mokni s.n.* (Personal Herbarium of Ridha El Mokni at the Faculty of Pharmacy of Monastir).

2. *Phoenix reclinata* Jacq. Fragm. Bot. 1: 27. t. 24. 1800 ≡ *Phoenix leonensis* Lodd. ex Kunth. Enum. Pl. 3: 257. 1841.

Dioecious clustering palm, variable in shape and form but tends to grow as clumps composed of multiple **stems** from 7.5 to 15 m in height and 30 cm in width. **Leaves** pinnate (bright to deep green in color) with a prounced sideways curve, growing 2.5 to 4.5 m in length and 75 cm in width, petioles with long, sharp spines at the base. Crown with 20 to 40 leaves. **Staminate inflorescence** erect; prophyll green-yellow in bud, strongly 2-keeled, coriaceous; rachis 17 – 30 cm. **Staminate flowers** creamy-white; calyx cupule 1 mm high; petals with apex acute-acuminate in shape and with jagged margins, 3 (rarely 4), 6 – 7 x 2 – 3 mm. **Pistillate inflorescence** erect, arching with weight of fruits; prophyll as for staminate inflorescence; peduncle green-yellow turning orange-brown, becoming pendulous on fruit maturity, to 60 – 1.5 cm. **Fruits** ovoid-ellipsoid or almost obovoid orange in color, 13 – 20 x 7 – 13 mm, mesocarp sweet, about 1 – 2 mm thick. **Seed** obovoid, with rounded apices (cf. Barrow 1998).

Flowering period: August to October, **Fruiting period**: February to April.

Notes on general distribution: *Phoenix reclinata* is indigenous to the semi-arid plains of Senegal, and occurs throughout tropical and subtropical Africa, northern and southwestern Madagascar and the Comoro Islands. It occurs naturally along the eastern seaboard of Africa, extending into Egypt (see e.g., Pooley 1993, APD 2020). *P. reclinata* is mainly riverine in distribution, where the root system plays an important part in bank stabilization, and occurs also in the brackish-water regions adjacent to mangrove forests (Wicht 1969), but it also grows in open savannah. Within the Mediterranean basin, this taxon seems to be reported only in Spain (GBIF database 2020). No records were made up till now for North Africa except from Algeria (GBIF database 2020).

Occurrence in Tunisia (Figure 4. A & B) **and casual status**: Tunisian plants grow within sidewalks near a public garden, in the government of Monastir. Since the taxon was found only at one locality, with one mature 3-stemmed individual and more than 20 juvenile seedlings, and this appears to be an ornamental tree resulting from the use of imported plants for gardening purposes. *Phoenix reclinata* is here evaluated as casual in Tunisia (Pyšek et al. 2004, Richardson & Pyšek 2006).

Specimina Visa: TUNISIA: Monastir (Monastir-City), margins of a private garden, 35° 46' 47" N, 010° 48' 59" E, 15 m a.s.l., 04 January 2019, *El Mokni* (*photos*).

3. *Phoenix theophrasti* Greuter, Bauhinia 3: 243. 1967.

Dioecious palm that has a clustering **stem** and can grow up to 15 meters. **Leaves** paripinnate (3–5 m long), obliquely vertical bluish-colored are composed of smaller, shorter and thicker leaflets compared to *P. dactylifera*. The tips of the leaflets are pointed and very sharp. **Flowers** in composite panicles, pedicel length grows to 30 cm in female plants which is twice as long as in the male plant. **Fruits** elliptical berries (12–16 mm long), mesocarp brownish yellow then black, soft, and edible (cf. Barrow 1998).

Flowering period: April to May, **Fruiting period**: September to October.

Notes on general distribution: *Phoenix theophrasti* is a rare endemic to the Aegean region. It was first discovered on the island of Crete (Greuter 1967). It was known only from coastal localities in Crete where the main occurrence being at Vai on the east coast (Barclay 1974, Anon. 1983). Its endemic area was extended by the continuous discoveries of the occurrence of occasional specimens within ten stands on Crete and nearby islands. It was then discovered in further northeast with the new sites on the Datça Peninsula of Turkey (Boydak 1983, 1985, Boydak & Yaka 1983). No more records were made up till now neither within the Mediterranean basin nor in North Africa (GBIF database 2020).

Occurrence in Tunisia (Figure 4. C) **and casual status**: Tunisian plants grow within a rocky coastal, in the government of Jendouba. Since the taxon was found only at one locality, with one mature 3-stemmed individual and more than 20 juvenile seedlings, and this appears to be an ornamental tree resulting from the use of imported plants for gardening purposes. *Phoenix theophrasti* is here evaluated as casual in Tunisia (Pyšek et al. 2004, Richardson & Pyšek 2006).

← **Figure 3:** *Phoenix canariensis* in Tunisia. A: juvenile plant from seedling as epiphytic on *Melia azedarach* (Bizerta-City, NE Tunisia; 09. 02. 2020); B: juvenile plant from seedling on a roof water pipe (Bizerta-City, NE Tunisia;15. 09. 2018); C & D: two different stages of juvenile plants growing within public gardens (Monastir, CE Tunisia; 25. 06. 2017). Photos by Ridha El Mokni.

Slika 3: *Phoenix canariensis* v Tuniziji. A: mlada rastlina kot epifit na vrsti *Melia azedarach* (mesto Bizerta, SV Tunizija; 09. 02. 2020); B: mlada rastlina na žlebu (mesto Bizerta, SV Tunizija; 15. 09. 2018); C & D: dve različni fazi mladih rastlin, ki uspevajo v javnih vrtovih (Monastir, CE Tunizija; 25. 06. 2017). Fotografije Ridha El Mokni.

Figure 4: A & B: *Phoenix reclinata* in the margin of a public garden within Monastir region (CE Tunisia; 04. 01. 2019); C: *Phoenix theophrasti* in wild within Tabarka region (NW Tunisia; 01. 05. 2018). Photos by Ridha El Mokni.
Slika 4: A & B: *Phoenix reclinata* na robu parka na območju mesta Monastir (CE Tunis; 04. 01. 2019); C: *Phoenix theophrasti* v naravi na območju Tabarka (SZ Tunizija; 01. 05. 2018). Fotografije Ridha El Mokni.

Taxonomic notes: Main distinctive characters of *Phoenix theophrasti* Greuter (vs *P. dactylifera* L.) are i) fruits not very elongated and rounded at the ends, ii) the presence of large thorns, iii) the large diameter of its stipe up to 50 cm, and iv) the systematic presence of shoots at its base as well as at mid-height.

Specimina Visa: TUNISIA: Jendouba, Tabarka, in a restricted rocky coastal locality within *Anthyllis barba-jovis* L. communities, 36° 57' 48" N, 008° 45' 23" E, 5 m a.s.l., 01 May 2018, *El Mokni* (*photos*).

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